

**Anticipated results  
from the  
Multi-angle Imaging SpectroRadiometer**



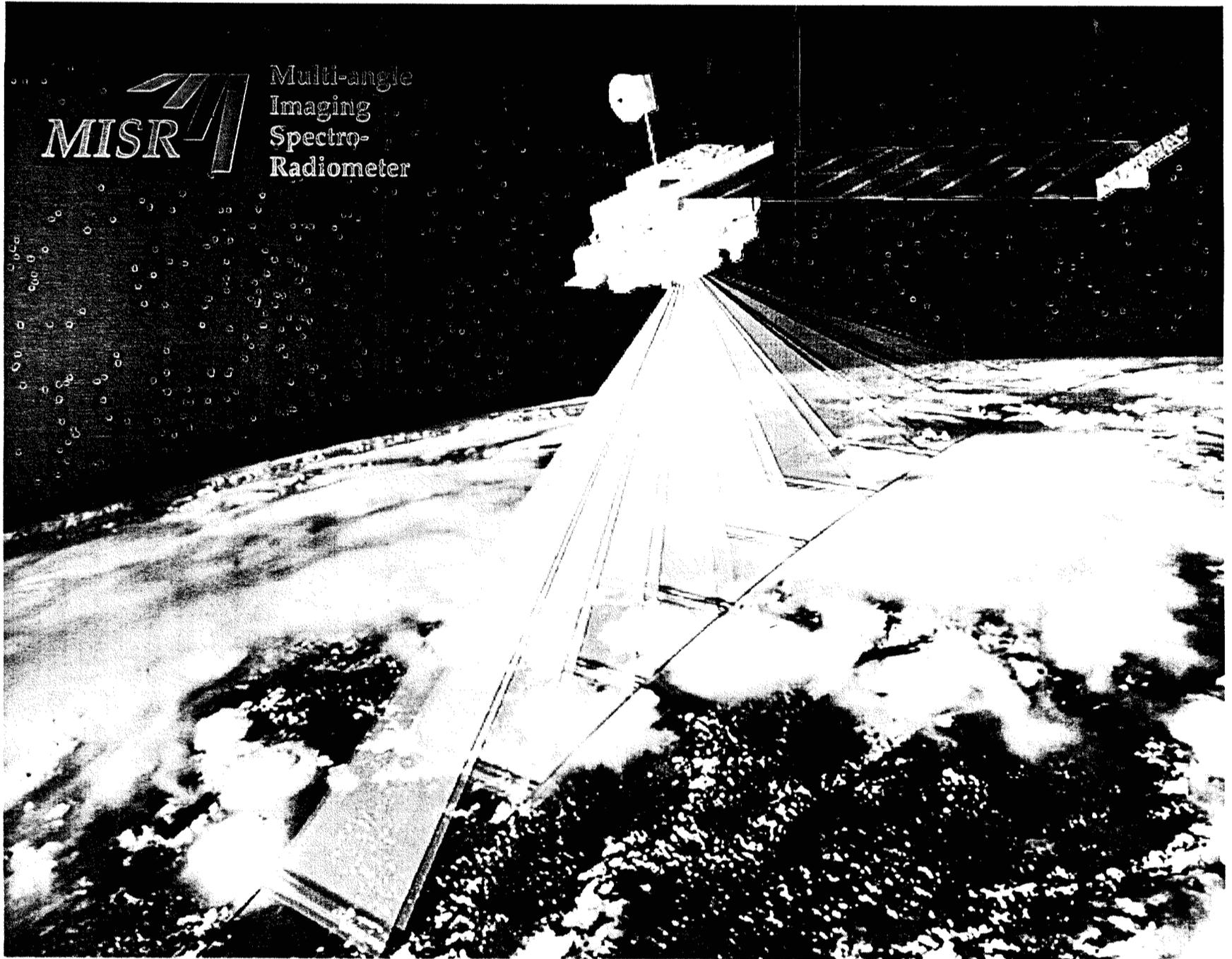
**David J. Diner**

**Second International Workshop on Multiangle Measurements and Models  
Ispra, Italy  
15 - 17 September, 1999**

**JPL**  
Jet Propulsion Laboratory  
California Institute of Technology

MISR

Multi-angle  
Imaging  
Spectro-  
Radiometer

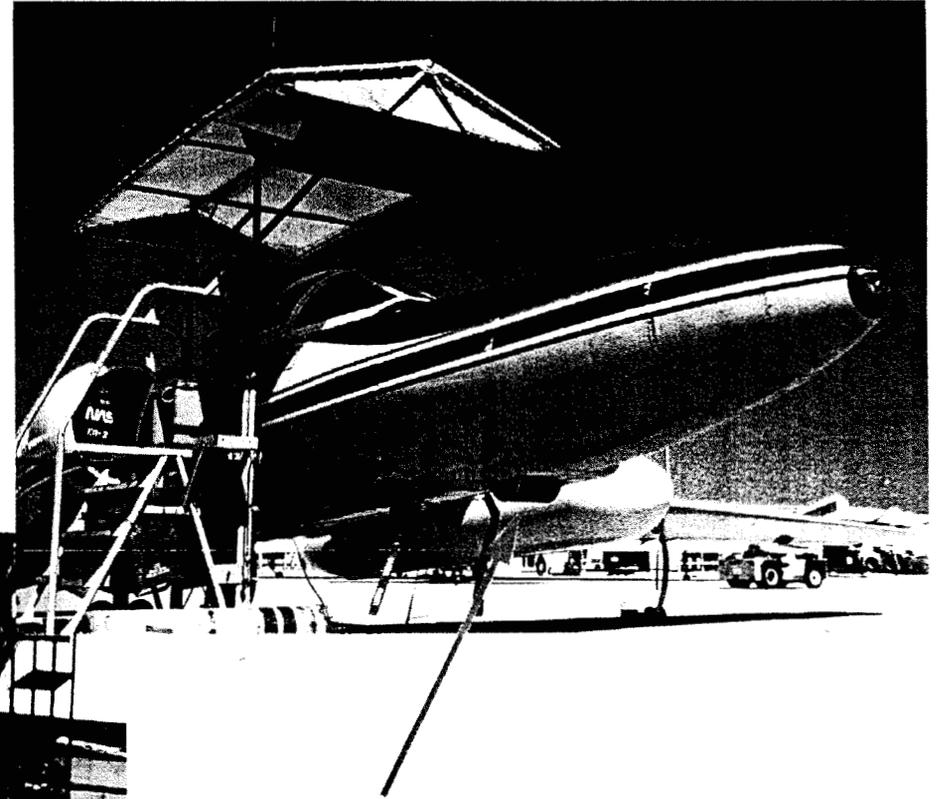


**JPL**

# MISR AND AirMISR INSTRUMENTS

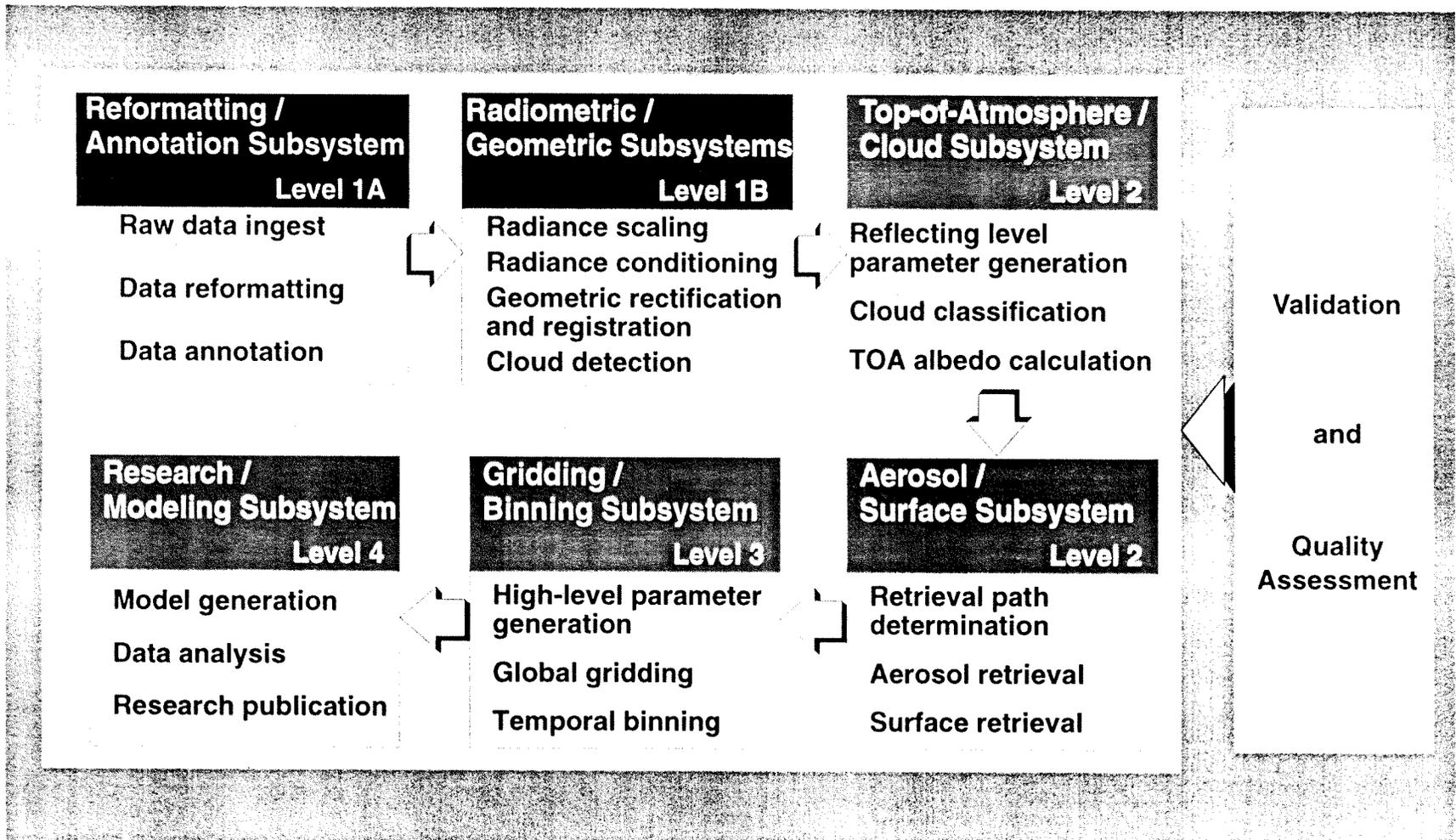
*MISR*

MISR on Terra spacecraft



AirMISR on NASA ER-2 aircraft

<b>Parameter</b>	<b>MISR</b>	<b>AirMISR</b>
Number of cameras	9	1 (gimballed)
View angles	0.0°, 26.1°, 45.6°, 60.0°, 70.5° (fore and aft)	Same
Spectral bands	446, 558, 672, 866 nm	Same
Ground sampling (georectified images)	275 m - 1.1 km	27.5 m
Swath width	360 km (9 day global coverage)	11 km
Time to observe single target	7 minutes	13 minutes
Azimuths relative to principal plane	From EOS-AM orbit 30° - 90°, depends on latitude/season	Selectable flight lines
Radiometric calibration	On-board and vicarious ± 3% at full signal	Laboratory and vicarious ± 3% at full signal
Signal-to-noise ratio	> 700 at full signal	Same
Quantization	14 bits	Same





# MISR ATMOSPHERE PRODUCTS

GLOBAL COVERAGE



MISR

Product	Process	BRDF Model
Reflecting level (cloud or surface) altitude	Multi-angle stereoscopic retrieval	None
Aerosol optical depth and compositional type	Aerosol retrieval over dark ocean, dense dark vegetation (DDV), or heterogeneous land	Heterogeneous land: Empirical Orthogonal Function angular expansion DDV: Rahman-Pinty-Verstraete (3 parameter) empirical BRF model Ocean: Cox-Munk glitter + whitecaps
Top-of-atmosphere BRFs and albedos	Geometric registration of multi-angle data to reflecting level altitude, and angular integration	Clear sky: Linearized form of Rahman-Pinty-Verstraete model Cloudy sky: Physically based Monte-Carlo radiative transfer models



Increasing  
BRDF model  
complexity

BRF - Bidirectional Reflectance Factor

Product	Process	BRDF Model
Spectral HDRFs and BHR	Requires aerosol retrieval and atmospheric correction of multi-angle measurements	Surface-leaving radiance form: $L(\mu, \phi - \phi_0) = L_0(\mu) + L_1(\mu) \cos(\phi - \phi_0)$
Spectral BRFs, DHR, and BRF model parameters	Inversion of multi-angle HDRFs using a multi-parameter BRF model	Linearized form of Rahman-Pinty-Verstraete model
Biome type, LAI, and FPAR	Spectral BRFs and BHR/DHR compared to values for various canopy/soil models in a look-up table (LUT)	3-D radiative transfer and physically-based canopy models



Increasing  
BRDF model  
complexity

HDRF - Hemispherical-Directional Reflectance Factor (proportional to surface-leaving radiance)  
BHR - Bihemispherical Reflectance (albedo under ambient illumination)

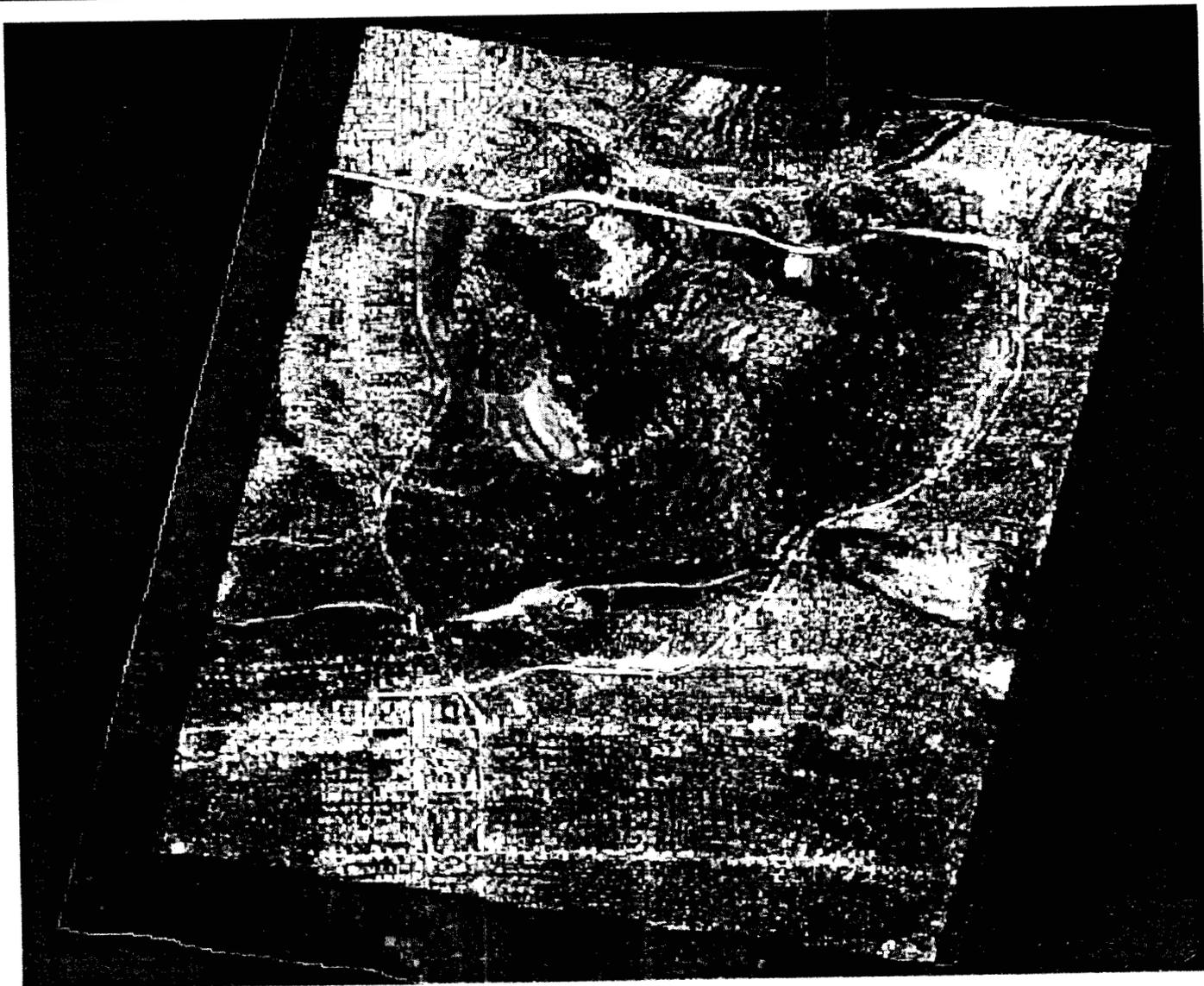
BRF - Bidirectional Reflectance Factor

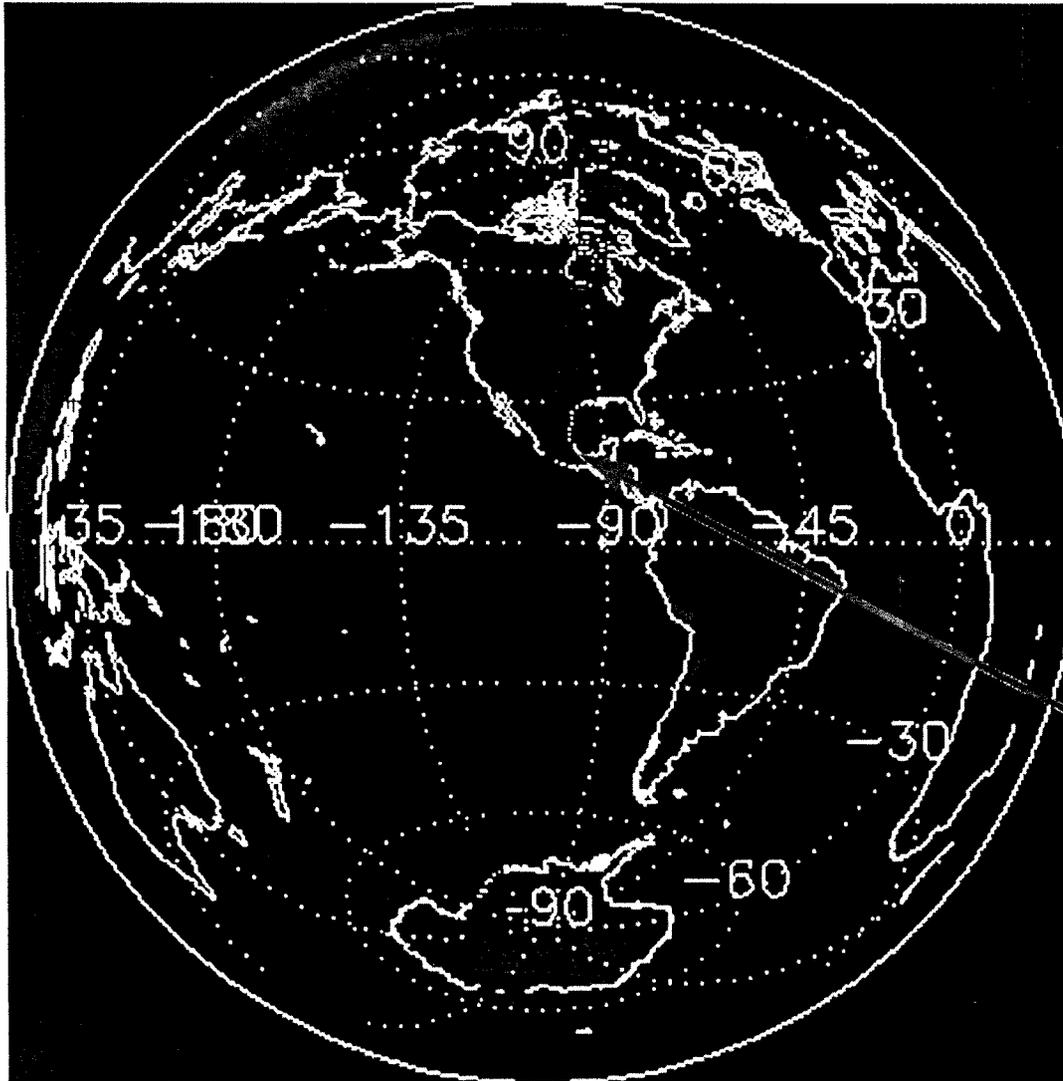
DHR - Directional-Hemispherical Reflectance (albedo under direct illumination only)

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**AirMISR STEREO ANAGLYPH  
JPL, PASADENA, CA -- 12/05/98**

**MISR**





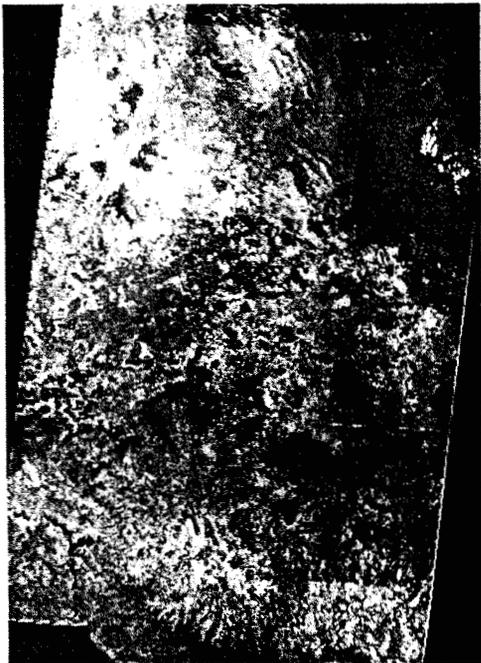
World  
Reference  
System  
Path 27

Location  
of simulated  
MISR data

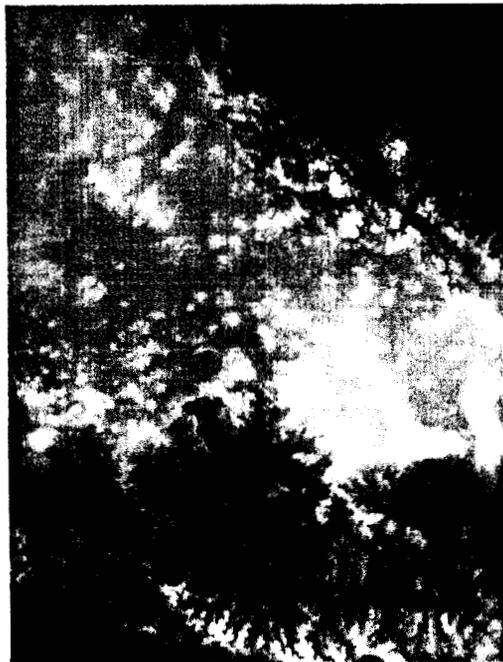
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# STEREOSCOPIC RETRIEVALS IN MISR TOA/CLOUD PROCESSING

**MISR**



**RADIANCE IMAGE**



**HEIGHT FIELD**



**RETRIEVED  
REFLECTING-LEVEL  
REFERENCE ALTITUDE**